

## A MONOGRAPH OF THE AUSTRALIAN LORICATES.

(Phylum MOLLUSCA—Order LORICATA).

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## VII.

## Genus AMAUROCHITON.

*Amaurochiton* Thiele, Das Gebiss der Schnecken (Troschel), ii., 1893, 362. Type by monotypy *Chiton olivaceus* Frembly.

*Pocilloplax* Thiele, id. ib., 365. Type by monotypy *Chiton glaucus* Gray.

The peculiar sculpture determines this genus at sight, and with it is associated the form of the girdle scales, which are rather large and rudely convex, closely imbricating and nearly smooth. The insertion plates are very short, finely pectinated, as is the sinus. The slitting of the anterior and posterior valves is numerous, 9 or 10—14, but only one slit is seen on each side of the median valves.

A well-marked group, localised in New Zealand and the west coast of South America. It is included here, as it is now established in southern Tasmania.

## AMAUROCHITON GLAUCUS.

Plate xxxvii., figs. 1, 22.

*Chiton glaucus* Gray, Spicilegia Zoologica, pt. i., 1828, 5. Locality unknown = New Zealand. Type in British Museum examined.

*Chiton viridis* Quoy & Gaimard, Voy. de l'Astrol. Zool., iii., 1835, 383, pl. 74, f. 23-28. New Zealand. Type in Brit. Mus. Not *Chiton viridis* Spengler, Skrivter af Naturhistorie-Selskabet., iv., 1797, 70.

*Chiton quoyi* Deshayes, Hist. Nat. Anim. sans Verteb., vii., 1836, 509. New name for *C. viridis* Q. & G. Pilsbry, Man. Conch., xiv., 1893, 172, pl. 37, f. 6-8.

*Chiton quoyi* subsp. *limosa* Suter, Journ. Malac., xii., 1905, 69. Manukau Harbour, North Island, New Zealand. Type in coll. Suter.

*Amaurochiton glaucus* Iredale, Proc. Mal. Soc., xi., 1914, 38, footnote. May, Illus. Index Tas. Shells, 1923, pl. xvi., f. 13.

Shell large, broadly oval, a little elevated, semi-carinated; the surface very finely striate throughout but presenting a glossy appearance; girdle scales shining. Colour generally dark bluish-green, but pale green, bright blue, red-brown, and white examples may be met with; generally unicolour, but a green or brown shell striped with white is common at certain localities.

Anterior valve very broad, radially rayed with 80-100 delicate ridges; in juvenile shells these ridges can be seen to be composed of small nodules strung together and coalescing with age.

Median valves with lateral areas a little elevated, similarly rayed with 20 ridges increasing by intercalation with age; central areas closely lined with similar ridges longitudinally arranged, a little slanting laterally and present on the jugum, 80-100 being counted across the valve.

Posterior valve with mucro at anterior third; post-mucronal slope nearly straight; post-mucronal area as anterior valve; ante-mucronal area as central areas.

Girdle covered with smooth squarish diamond-headed scales, somewhat resembling those of *Ischnoradsia*.

Interior generally bluish-green, but varying a little, according to exterior colouration. Slits 9-10-1-14-15.

Dimensions: 45 x 30 mm.

Station: Under stones between tide marks.

Habitat: Southern Tasmania, apparently introduced from New Zealand.

Genus *SYPHAROCHITON*.

*Sypharochiton* Thiele, Das Gebiss der Schnecken, ii., 1893, 365. Type by monotypy *Chiton pelliserpentis* Quoy & Gaimard. (Voy. Astrol. Zool., 1835, 381).\*

*Triboplax* Thiele, id. ib. Type by monotypy *T. scabricula* = *pelliserpentis* Q. & G.

Another well-marked group, endemic in Eastern Australia from Port Stephens, to Montague Island, New South Wales, and on the east and north coasts of Tasmania; abundant throughout New Zealand, with small forms at the Kermadec, Lord Howe and Norfolk Islands.

Shell large to small, oval, round-backed, not much elevated, sculptured with coarse nodulose radials and fine longitudinal; girdle having coarse striate scales loosely packed. Insertion plates in all valves, strongly toothed; slits in anterior valve regularly more than 8, median 1, posterior 12; sinus toothed in second valve only, otherwise not denticulate though plate present; posterior insertion plate tending forward. The small forms may be distinguished by the degeneration of the teeth, and should constitute a subgenus.

*SYPHAROCHITON SEPTENTRIONES*.

Plate xxxvii., figs. 2, 4, 29.

*Sypharochiton pellis-serpentis* subsp. *septentriones* Ashby, Trans. Roy. Soc. S. Aust., xlviii., 1925, 321. New South Wales. Type in coll. Ashby.

*Chiton pellis-serpentis* Cox, Proc. Linn. Soc. N.S.W., viii., 1894, 428. Port Jackson and Port Hacking, N.S.W.

Shell large, oval, elevated, round-backed; colour generally dark brown or black, but many may be found with one or more valves wholly or partly pale green or white.

Anterior valve strongly nodulose, nodules in rays and cut by concentric growth lines; twenty to thirty radials having ten to fifteen nodules to each radial.

Median valves with lateral areas well raised and similarly sculptured, but not so prominently; pleural areas closely ridged longitudinally throughout, interstices latticed, weaker on the jugum; sometimes notably sculptured with growth lines.

Posterior valve with mucro elevated at anterior fourth; post-mucronal slope straight.

Girdle scales large, oval, closely striate, not shining.

Interior bluish-green, deeper medially. Slitting 11-1-14.

Dimensions: 42 x 28 mm.

Station: On the surface of the littoral rock, in crevices, or in depressions above median tide mark; less frequently, and generally in juvenile stages, under stones below median tide mark. This is one of the emergent species, and examples are often found above neap high water mark. Nearly all adult examples are greatly eroded or overgrown with parasitic algae.

\* Note:—Quoy and Gaimard named this shell "*pelliserpentis*" (Peau-de-serpent). Numerous writers have altered the spelling to either "*pelliserpentis*" or "*pellis-serpentis*." We use the authors' spelling.

Habitat: New South Wales.

Remarks: *S. maugeanus* attains larger proportions, is more elongate, and more elevated; the sculpture is less pronounced, the girdle scales less strongly striate, shining. The New Zealand *S. pelliserpentis* Q. & G. is distinguishable from the New South Wales shell by its more elongate shape, less pronounced pleural sculpture, and the very weak striation of the girdle scales, which also are not shining. *S. sinclairi* Gray has finely striate, shining girdle scales; the pleural areas are smooth or with short longitudinal grooves.

#### SYPHAROCHITON MAUGEANUS.

Plate xxxvii., fig. 3.

*Sypharochiton maugeanus* Iredale & May, Proc. Mal. Soc., xii., 1916, 114, pl. v., f. 5. Port Arthur, Southern Tasmania. Type in Tasmanian Museum.

*Sypharochiton pellis-serpentis* Quoy & Gaimard: Ashby, Trans. Roy. Soc. S. Aust., xli., 1922, 20. (Includes *S. sinclairi* Gray!). (Not *Chiton pelliserpentis* Quoy & Gaimard). May, Illus. Index Tas. Shells, 1923, pl. xvi., f. 12.

Shell large, elevated, carinated, side slopes convex. Colour generally dark to blackish brown, but frequently with valve ii. wholly black, the jugum black, and the other valves yellowish-white, sometimes flamed with black.

This shell differs from *S. septentriones* in the larger size, more oval shape, weaker sculpture, more weakly striate and glossy girdle scales. The variation in sculpture was commented on by Iredale and May, and more material has shown this variation to be a marked feature of the southern Tasmanian species, hence the reports of *S. sinclairi* from that locality. The species, further, in comparison with the New South Wales species, is more elevated, with the mucro more central, more elevated, and consequently the post-mucronal area is more pronounced.

Interior: Greenish, darker medially. Slits 10-11—1—12-14.

Dimensions: 63 x 35 mm. (dried).

Station: This species appears to frequent the water much more than the Peronian shell which, like the New Zealand species, lives near or even above high water mark. Hence, while the two latter are generally represented by eroded shells, the former can be procured in fine, bright specimens with little or no erosion.

Remarks: Examples from the north coast of Tasmania are generally smaller and more elevated; the sculpture bolder and more like the New Zealand species. No examples have been taken in Victoria nor in Twofold Bay, New South Wales, the Peronian species appearing to die out about Montague Island.

#### SYPHAROCHITON MAYI.

Plate xxxvii., figs. 6, 7, 8.

*Ischnochiton (Haploplax) mayi* Pilsbry, Nautilus, viii., 1895, 128. Eagle Hawk Neck, East Coast, Tasmania. Type in Acad. Philad.

*Ischnochiton mayi* Hedley & Hull, Rec. Aust. Mus., vii., 1909, 264, pl. lxxiv., f. 28. May, Illus. Index Tas. Shells, 1923, pl. xiv., f. 13.

*Ischnochiton (Haploplax) mayi* var. *viridis* Ashby, Trans. Roy. Soc. S. Aust., xliv., 1920, 264, pl. xi., f. 2. D'Entrecasteaux Channel, Tasmania.

Shell small, rounded oval, semi-carinated, side slopes curved, valves beaked. Colour black, pale green with black girdle (var. *viridis* Ashby).

Anterior valve finely quincuncially punctate, developing into small tubercles arranged concentrically, not radially, towards the margin.

Median valves with central areas finely quincuncially punctate, fine lines suggested towards the edge; lateral areas raised, similarly sculptured, but

tubercles developing towards the edge and massed by growth lines, more prominent with age.

Posterior valve with mucro ante-median; ante-mucronal area quincuncially punctate; post-mucronal area showing small tubercles arranged concentrically, but not so marked as on the anterior valve.

Girdle broad, covered with small, rounded, rather coarse scales, finely striate with six to eight shallow grooves.

Interior blue; slits 10-1-12, teeth degeuerate, pectination obsolete.

Dimensions: 20 x 12 mm.

Station: Under or upon stones above median tide mark.

Habitat: Tasmania (Port Arthur, D'Entrecasteaux Channel, Frederick Henry Bay, Maria Island, Tamar Heads).

Remarks: May & Torr (Pap. and Proc. Roy. Soc. Tas., 1912. 31), give the general dimensions as "breadth is three-fourths of the length," but none of our dried examples is relatively as broad.

#### Genus SQUAMOPLEURA.

*Squamopleura* Nierstrasz, Siboga Expeditie (Der Chitoneu) Mon., xlviii, 1905, 102. Type by monotypy *Squamopleura imitator* Nierstrasz from Java, a species of *Sclerochiton* preoccupied.

*Sclerochiton* Dall, Proc. U.S. Nat. Mus., 1881, 287, 289, ex Cpr. M.S. Nom. nud. Pilsbry, Man. Conch., xiv., 1893, 188, ex Cpr. M.S. Type by monotypy *Chiton miles* Pilsbry, ex Cpr. M.S. Not *Sclerochiton* Kraatz, Wiegmann's Archiv. fur Naturg., xxv., 1859, 133.

This group seems to be related to *Sypharochiton*, and also to *Liolophura*, but in the type species the sculpture is like that of the latter, while in another series it is different, though not like that of the former.

Shells medium to large, oval, round-backed, depressed, sculpture coarse, nodulose radials and longitudinal nodulose ribs; girdle scales small, loosely packed, striate; anterior insertion plate short, sharply denticulate, eight-slit; median valve similarly denticulate, one-slit, sinus with a projecting wedge not denticulate; posterior insertion plate reduced almost to a callus, but finely toothed, sometimes two well-developed slits at the sides, but the intermediate slitting is indistinct.

#### SQUAMOPLEURA CURTISIANA.

Plate xxxvii., figs. 5, 26, 27.

*Chiton (Ischnochiton) curtisianus* Smith, Zool. Coll. Alert, 1884, 78, pl. vi., f. D. Port Curtis, Queensland. Type in Brit. Mus.

*Ischnochiton curtisianus* Pilsbry, Man. Conch., xiv., 1892, 97, pl. 24, f. 6.

*Enoplochiton torri* Bastow & Gatliff, Proc. Roy. Soc. Viet., xx., 1907, 27, pl. iii. & iv. Queensland.

*Sclerochiton aruensis* Thiele, Revision Chitonen (Chun's Zoologica, Heft 56), 1910, 96, pl. x., f. 36-41. Type in Berlin Museum.

*Liolophura curtisiana* Pilsbry, Man. Conch., xiv., 1893, 242. Hedley & Hull, Rec. Aust. Mus., vii., 1909, 265.

*Sclerochiton curtisianus* Iredale, Proc. Mal. Soc., ix., 1910, 103.

Shell medium, depressed, round-backed, oval; sculpture notable; girdle with very small scales. Colour dull brown or olive green with wedge-shaped black markings on the jugum.

Anterior valve closely covered with small rounded nodules of different sizes, not arranged in rows; strong concentric growth lines present; numerous black eyes are irregularly distributed.

Median valves with lateral areas scarcely raised, similarly sculptured; pleural areas sculptured with longitudinal rows of nodules, about twelve distinct on each

side, then massed and indistinct over the jugum; growth lines, marked with age.

Posterior valve with muero little elevated, sub-central; post-mueroal slope straight; post-mueroal area sculptured as anterior valve; ante-mueroal area as pleural area.

Girdle moderately broad, covered with very small, numerous scales, loosely packed, striate.

Interior bluish, medially blotched with purple. Slits 8-1-2. Callus regularly striate.

Dimensions: 16 mm. long (type), 24 x 16 mm. (Anson Bay, Northern Territory).

Station: On the upper side of stones in mud and on the piles of the wharf at Port Curtis, in the attached valves of dead oysters or in the interstices between clumps of that shell; on the outside of littoral rocks (Port Denison), amongst oysters on the hull of an iron ship wrecked at Magnetic Island, Queensland; and on the stones of a breakwater at Redeliff, Brisbane River.

Habitat: Queensland, from Brisbane to Cape York; Northern Territory, Point Torment, North Western Australia.

SQUAMOPLEURA CARTERI, n.sp.

Plate xxxvii., figs. 18, 20, 28.

*Sclerochiton curtisianus* Smith, Ashby, Proc. Roy. Soc. West. Aust., viii., 1923, 34. Point Cloates, W.A. Not of Smith *supra*.

*Sclerochiton miles* Pilsbry, Ashby, Trans. Roy. Soc. S. Aust., xvii., 1923, 231, pl. xviii., f. 3 a-d. Carnarvon, W.A. Not of Pilsbry *infra*.

[*Sclerochiton thielei* Ashby, id. ib., 233, Sumatra, is an absolute synonym of *Squamopleura imitator* Nierstrasz, Siboga Expeditie, xlviii., 1905, 102, f. 212-218. Java].

Shell large, round-backed, broadly oval, depressed, sculpture weak, girdle with small scales. Colour yellowish-green, with brown stripe on the jugum.

Anterior valve broad, closely covered with fine nodules, and showing concentric growth lines.

Median valves with laterals a little raised, sculptured with nodules as anterior valve; pleural areas marked with fine transverse lines, a few wrinkled longitudinally at the edge.

Posterior valve with muero depressed, submedian.

Girdle scales small, loosely packed, striate, larger than those of *S. curtisiana*.

Interior bluish, medially blotched with purple. Slits 8-1-2. Callus coarsely striate.

Dimensions: 40 x 20 mm.

Station: On the upper side of flat littoral rocks near high water mark.

Habitat: Point Cloates, North Western Australia.

Remarks: The type of this species, collected by Mr. Tom Carter, is in the Western Australian Museum. Ashby recorded the species as *S. miles* which, however, it does not resemble, but agrees more closely with the form he has called *S. thielei*, which is identical with *S. imitator* Nierstrasz. It is interesting to find the range of the forms concurrent, so that we may suggest different origin, and that this species, and *S. imitator*, go together. Showing the sculpture of *Liolophura* and *Clavarizona*, they may be more closely allied to those genera; while *S. curtisiana* may be near *Sypharochiton*.

[SQUAMOPLEURA MILES.

*Chiton (Sclerochiton) miles* Pilsbry, Man. Coneh., xiv., 1893, 189, pl. 46, f. 1-5.

Torres Strait. Mus. Cuming in Brit. Mus.

*Ischnochiton araucarianus* Hedley, Proc. Linn. Soc. N.S.W., xxiii., 1900, 100, fig.



in text. Isle of Pines, New Caledonia.

Paratypes of *araucarianus* were compared by Iredale with the type of *miles* in the British Museum, and he noted "the type of *miles* is smaller, the scales are more closely packed, probably through drying; same irregularity in size, and similarly striated; both worn, but sculpture similar; would not separate them." Hull has collected a series on the Islands of the Loyalty group, and a further comparison of these reveals no characters that can be utilised for separation. *S. miles* may be removed from the Australian list, the locality cited (Torres Strait) being erroneous; the type was probably collected by Maegillivray at the Island of Pines].

Genus CLAVARIZONA.

*Clavarizona* Hull, Aust. Zool., iii., 1923, 199. Type by original designation *Chiton hirtosus* Blainville.

Similar to *Liolophura*, excepting the girdle covering, which consists of short, obtuse, striated scales, resembling the heads of aboriginal clubs or nulla nullas.

CLAVARIZONA HIRTOSA.

Plate xxxvii., figs. 9-12, 17, 21.

*Chiton hirtosus* Blainville, Dict. Sci. Nat. (Levrault), xxxvi., 1825, 546 (ex Peron M.S.). Seas of King Island, error = King George Sound, South Western Australia. Type in Paris Mus.

*Chiton georgianus* Quoy & Gaimard, Voy. Astrolabe, Zool., iii., 1835, 379, pl. 75, f. 25-30. King George Sound, South Western Australia. Type in Paris Mus.

*Liolophura georgiana* Pilsbry, Man. Coneh., xiv., 1893, 241, pl. 53, f. 36-40.

*Acanthopleura (Liolophura) georgiana* Thiele, Fauna Sud.-West. Aust., 1911, 399.

*Plaxiphora pustulosa* Torr, Trans. Roy. Soc. S. Aust., xxxv., 1911, 107, pl. xxv., f. 7. Albany, South Western Australia (founded on a valve). Type in coll. Torr.

*Clavarizona hirtosa* Hull, Aust. Zool., iii., 1923, 199, pl. xxviii., f. 9-12.

Shell large, broadly oval, moderately carinated, side slopes convex. Colour olive-green, brown or black, the two former generally having the dorsal area darker in a series of V-shaped markings, the black shells occasionally exhibiting on one or more of the median valves white patches which extend to the adjacent parts of the girdle.

Anterior valve crowded with oval tubercles, irregularly radiating towards the margin; several concentric growth lines causing undulation of the surface.

Median valves with lateral areas strongly differentiated, sculptured with eight or more radiating rows of elongated polished tubercles: central areas with numerous wavy concentric lines over the dorsal area, and breaking up into large oblong tubercles becoming more pronounced towards the margins. Valve ii. also shows three or more vertical lines on the dorsal area, crossing the wavy lines and converging posteriorly.

Posterior valve with projecting terminal mucro, the large ante-mucronal area sculptured similarly to the central areas of the median valves; the post-mucronal area almost recurved, and sculptured with a few elongate tubercles.

All valves with numerous ocelli, scattered on valve i., and chiefly along the diagonal in two or more rows in valves ii. to viii.

Girdle densely clothed with short obtuse or conical striated scales; colour generally in bands of white and black alternating, the portions in front of the anterior and behind the posterior valves being white.

Interior purple-brown, sutural laminae whitish. Anterior valve with 10 slits, median valves 1-slit; all insertion plates deeply pectinated; posterior valve with broad rough callus.

Dimensions: 60 x 35 mm. (dried shell).

Station: On the surface or in crevices of the rocks between high spring and mean tide marks. Juveniles are sometimes found under stones.

Habitat: South Western Australia.

#### Genus LIOLOPHURA.

*Liolophura* Pilsbry, Nautilus, vi., 1893, 105. Type by original designation

*Chiton japonicus* Lischke.

*Lioloppleura* Cox, P.L.S., N.S.W., ser. 2, viii., 1893, 426.

Valves exposed, dull and somewhat roughened, generally eroded outside, with minute eyes irregularly scattered over the lateral areas, the head-valve and the sides of the central areas. Interior dark coloured, having anterior and side insertion-plates slit into teeth and sharply pectinated outside; posterior valve with posterior terminal mucro, lacking the insertion-plate, which is represented by a flat callous ledge. Girdle covered with stout calcareous spines of varying sizes.

#### LIOLOPHURA GAIMARDI.

Plate xxxvii., figs. 13-16, 19, 31.

*Chiton gaimardi* Blainville, Dict. Sci. Nat. (Levrault), xxxvi., 1825, 546. Port Jackson, New South Wales. Type in Paris Mus.

*Chiton incanus* Gould, Proc. Bost. Soc. Nat. Hist., ii., 1846, 145, New South Wales. Type in Philad. Acad. United States Expl. Exped. Moll., 315. Atlas, pl. 28, f. 432, 432a.

*Maugeria incanus* Gould, Otia Conch., 1862, 248.

*Acanthopleura incana* Smith, Zool. Coll. Alert, 1884, 81. Haddon, Zool. Challenger, xv., 1886, Polypl., 25.

*Liolophura gaimardi* Pilsbry, Man. Conch., xiv., 1893, 240, pl. 53, f. 30-35. Hull, Aust. Zool., iii., 1923, 198, pl. xxviii., f. 1-4.

Shell the smallest of the genus; broadly oval, depressed, round-backed, valves beaked. Colour greenish-grey to blackish-brown, with a V-shaped black marking on the jugum of valves ii. to viii.

The sculpture of all valves consists of wavy, concentric, nodulose ridges, the nodules becoming more pronounced towards the margins; lateral areas not very clearly differentiated.

Posterior valve with mucro post-median, post-mucronal slope concave.

Girdle alternately black and white barred, densely covered with calcareous spines of three distinct forms: (a) small, pebbly, rounded, irregular scales, (b) larger conical truncated spines, (c) long, pointed, slightly curved spines.

Interior dull purple, sutural laminae white.

Dimensions: 45 x 25 mm. Slits: 10-11-1-0.

Station: On the upper surface of rocks, in crevices, and on the dead shells of rock oysters, between high water and median tide mark.

Habitat: New South Wales, from Port Hacking to Broken Bay (about 40 miles of coast line from point to point, not including some hundreds of miles of indentations of the four harbours opening on to the coast).

Remarks: Very common in Port Jackson and Broken Bay, but rare on the ocean front. Valves nearly always eroded, even in very young examples. It is quite possible that this species may be yet found outside the very limited habitat abovementioned.

LILOPHURA QUEENSLANDICA.

Plate xxxvii., figs. 23-25, 30, 32.

*Liolophura gaimardi queenslandica* Pilsbry, Proc. Acad. Nat. Sci. Philad., 1894, 87. Bundaberg, Queensland. Type in Philad. Acad.

*Liolophura queenslandica* Hull, Aust. Zool., iii., 1923, 199, pl. xxviii., f. 5-8.

Shell larger than the preceding species; anterior valve covered with oval tubercles, not arranged in any distinctly radial lines; lateral areas of median valves clearly differentiated, sculptured with seven or more radiating rows of oval tubercles; central areas horizontally lined.

Posterior valve with mucro nearly terminal; ante-mucronal area horizontally lined; post-mucronal area tuberculate.

Girdle scales somewhat similar to those of *L. gaimardi*, but smaller, the conical type predominating.

Interior dark purple-brown, sutural laminae lighter. Slits: 10-11—1—0.

Dimensions: 55 x 35 mm.

Station: Similar to that of *L. gaimardi*, and also under stones in rock pools.

Habitat: Northern New South Wales, Queensland to Townsville.

Remarks: Very common on the ocean coast, even in the most exposed positions, where the valves are generally eroded; when found under stones in rock pools the sculpture is less affected, examples being occasionally found with the sculpture intact. In the latter station the girdle is distended to such an extent that the scales and spines are widely separated, showing the white surface of the integument to which they are attached. Upon removing the shell from the stones the girdle rapidly contracts, and the covering scales and spines become crowded together, as seen in all dried specimens.

Genus ACANTHOZOSTERA, n. gen. \*

Type *Chiton gemmatus* Blainville.

Shells large, round-hacked, depressed, oval, sculpture coarse, small nodules on anterior valve and lateral areas, pleural areas with irregular linear nodules; posterior valve with mucro prominent, elevated, terminal; girdle densely clothed with long, slightly curved or straight calcareous spines, alternately banded in black and white, insertion plates in all valves long and strongly denticulate, that of the posterior valve almost perpendicular; teeth coarse, deeply grooved exteriorly, irregularly spaced, 8-12 in anterior and posterior valves, invariably 1 on each side of the median valves. Differs from *Amphitomura* Pilsbry (*Nautilus* vi., 1893, 105. Type by original designation *Chiton borbonicus* Deshayes = *brevispinosus* Sowerby) in that the latter has the mucro depressed, and the insertion plate of the posterior valve reduced almost to a striated callus, with two well-pronounced lateral teeth.

ACANTHOZOSTERA GEMMATA.

Plate xxxvii., figs. 33, 34.

*Chiton gemmatus* Blainville, Diet. Sci. Nat. (Levrault), xxxvi., 1825, 544. New Holland. Type in Paris Mus. ?

*Acanthopleura spiniger* E. A. Smith, Zool. Coll. Alert, 1884, 81. Haddon, Zool. Challenger, xv., 1886, Polypl., 23. Not *Chiton spiniger* Sowerby, Mag. Nat. Hist. (Charlesworth), iv., 1840, 287, Suppl., pl. xvi., f. 2. Loc. unknown. Type lost.

\* See *Amphitomura*, p. 170, ante.



*Acanthopleura gemmata* Iredale, P.Z.S., 1914, 668.

*Acanthopleura gemmata queenslandica* Ashby, Journ. Proc. Roy. Soc. West Aust., viii., 1923, 30. Dunk Island, Queensland. Type in coll. Ashby.

[*Chiton cummingshami* Reeve, Conch. Icon., iv., 1847, pl. xxvii., sp. & f. 181. Australia. Type in Brit. Mus. appears to be *Amphitomura brevispinosa* Sowerby, and not Australian].

Shell large, round-backed, depressed; colour brown or greenish-grey, with inverted V-shaped markings or straight dorsal line in black on valves ii. to viii., or wholly black.

Anterior valve minutely granulose throughout, studded with large tubercles, rarely rayed or forming concentric lines; small eyes notable.

Median valves minutely granulose throughout; pleural areas often showing no other sculpture, sometimes with tubercles also; lateral areas small, slightly raised, with irregular larger tubercles, sometimes rayed.

Posterior valve with mucro elevated, post-median: post-mucronal slope a little convex.

Girdle broad and fleshy, densely covered with long calcareous spines, slightly curved or straight, black, green or white, generally alternately banded.

Interior purplish-brown, sometimes showing a bluish sheen medially, and paler laterally. Slits 8-12—1—8-12.

Dimensions: 95 x 60 mm. (dried example), living examples may be found up to 120 x 80 mm.

Station: On the surface or in crevices of rocks or coral "nigger heads": or under stones above median tide mark, frequently at or near high water mark.

Habitat: Tropical Australia (Torresian Region, including the whole coast-line from Darwin east and south to Port Curtis, and west and south to Bunbury).

Remarks: The variation in this species is seen mostly in shape—broad or narrow—elevation, size, density and length of girdle spines. The very extensive series examined from the entire Torresian Region discloses no geographical difference between eastern and western examples, a great deal of the variation being due to the ecological environment. Erosion is general, as is usual with emergent species; it is worthy of remark, however, that fully adult specimens in perfect condition, without any trace of erosion, have been taken from under stones above median tide mark.

#### Genus ACANTHOPLEURA.

*Acanthopleura* Guilding, Zool. Journ., v., 1829, 27. Type by subsequent designation (Gray, P.Z.S., 1847, 168) *Chiton spinosus* Bruguiere.

*Francisia* Dall, Proc. U.S. Nat. Mus., 1881, 284, 289, 290; 1882, ex Cpr. M.S. Type by monotypy *Chiton spinosus* Bruguiere.

Shell large, round-backed, depressed, oval, sculpture finer than in *Acanthozostera*, girdle spines exceedingly long and curved. The long teeth of the insertion plate in the anterior valve, more than half the length of the tegmentum, and the slitting (more than one) of the median valves, characterise this group internally; the very long girdle spines distinguishing the genus superficially.

#### ACANTHOPLEURA SPINOSA.

Plate xxxviii., figs. 1, 2.

*Chiton spinosus* Bruguiere, Journ. d'Hist. Nat. (Paris), i., 1792, 25, pl. 2, f. 1, 2 A.B.C. Loc. unknown. Type lost. *Chiton spinosus* Burrows, Elem. of

Conch., 1815, 185, pl. xxvi., f. 4. Loc. unknown. Type lost.

*Chiton spinosus* Reeve, Conch. Icon., iv., 1847, pl. 9, f. 51.

*Francisia spinosa* Haddon, Zool. Challenger, xv., 1886, Polypl., 30.

*Acanthopleura spinosa* Pilsbry, Man. Conch., xiv., 1893, 220, pl. 45, f. 80-87.

*Acanthopleura spinosa* var. *montebelloensis* Ashby, Journ. Proc. Roy. Soc. West Aust., viii., 1923, 32. Monte Bello Island. Type in coll. Ashby.

Shell large, depressed, round-backed, oval. Colour wholly blue-black.

Anterior valve very finely radially ribbed with minute nodules, concentrically finely lined with minute growth lines.

Median valves with lateral areas scarcely raised, sculptured as in anterior valve; pleural areas smooth, valve crossed by minute growth lines.

Posterior valve with mucro elevated, at posterior fourth; post-mucronal area convex, sculptured as anterior valve. ante-mucronal area as pleural area, growth lines more marked.

Girdle broad, fleshy, covered with very long, curved, black spines.

Interior bluish-white, purple medially. Slits 15-16-13-8-10.

Dimensions: 77 x 46 mm.

Station: On the surface of rocks above median tide mark.

Habitat: North-western, North-eastern and Northern Australia. (Extra-limital, Java, Timor, New Guinea, Philippine Islands, New Caledonia).

Tropical Northern Australia.

#### Genus ONITHOCHITON.

*Onithochiton* Gray, P.Z.S., 1847, 65. Type by subsequent designation (id., p. 169) *Chiton undulatus* = *O. neglectus* Rochebrune.

*Ornithochiton* Cpr., in Dall, Proc. U.S. Nat. Mus., 1881, 284. (Emendation only).

Shell small to large, round-backed, oval, elevated; sculpture of nodules or fine linear longitudinal; girdle fleshy, very finely spiculose; posterior valve with callus only; insertion plates finely denticulate, as is the sinus; sutural laminae large; eight slits in anterior valve, one on each side of median valves.

#### ONITHOCHITON QUERCINUS.

Plate xxxviii., figs. 4-9.

*Chiton quercinus* Gould, Proc. Bost. Soc. Nat. Hist., ii., 1846, 142. New South Wales. Type in Philad. Acad. U.S. Expl. Exped. Moll., 312, f. 437.

*Chiton incii* Reeve, Conch. Icon., iv., 1847, pl. xvi., sp. 94, f. 96 = 94. Raines I., Torres Strait. Capt. Ince. Type in Mus. Cuming in Brit. Mus.

*Onithochiton rugulosus* Angas, P.Z.S., 1867, 115, pl. xiii., f. 29. Port Jackson, New South Wales. Type in Brit. Mus.

*Onithochiton lyellii* Pilsbry, Man. Conch., xiv., 1893, 247, pl. 55, f. 1-7.

*Onithochiton quercinus* id. ib., 248, pl. 55, f. 12, 13.

*Onithochiton rugulosus* id. ib., 249, pl. 55, f. 19.

*Onithochiton scholvi* Thiele, Revision Chitonen (Chun's Zoologica, Heft 56), ii., 1910 = Dec., 1909, 99, pl. x., f. 60, 61. New South Wales. Type in Berlin Museum. Ashby, Trans. Roy. Soc. S. Aust., xlvii., 1923, 230, pl. xviii., f. 1.

Shell large, elongate oval, round-backed, weakly sculptured. Colour extremely variable and brilliant, consisting generally of wavy vertical splashes of red, brown or green on a creamy or buff ground, with darker smaller splashes on the jugum; sometimes entirely black, deep red, rose, or green; occasionally with one or more valves in black and the others having the vertical coloured wavy splashes.

Anterior valve with nine radial rows of eyes separated by series of crescentic sulci giving an appearance of imbricating flattened, broad scales (*quercinus*). sometimes with the rows of eyes indistinct, otherwise smooth save for growth

lines (*scholvieni*); juvenile with bolder nodule-like markings, apical portion smooth (*rugulosus*).

Median valves with lateral areas little raised, a semi-nodulose diagonal rib, crossed by longitudinal wavy close-set riblets which pass across the pleural areas, becoming weak on the jugum (*quercinus*); otherwise with lateral areas scarcely raised, smooth save for growth lines, pleural area with a few slight longitudinal cuts vanishing on the jugum (*scholvieni*); juvenile with well marked nodulose rib separating the lateral from the pleural area, and another nodulose rib touching the lateral; pleural area well ridged (*rugulosus*).

Posterior valve with mucro depressed, terminal; sculpture agreeing with that of preceding valves.

Girdle very broad, fleshy, very finely spiculose.

Interior pinkish-white with central purple blotch. Slits 8-1-0, callus well formed.

Dimensions: 60 x 32 mm.

Station: On the upper side or at the edge of insertion of stones in deep pools, below low water mark; or on the surface or in crevices of rocks above median tide mark. In the former station nearly\* all examples are in perfect condition, the girdle is soft and spongy, and delicately veined in red. In the latter station the examples are almost invariably very old, eroded or overgrown with *Lithothamnium*, and the girdle is leathery, banded black and yellow.

Habitat: New South Wales; Queensland as far north as Mackay (? Raine I.); Western Australia from Esperance to Abrolhos Is.

Remarks: Thiele described as from New South Wales a new species, *O. scholvieni*, and Iredale recognised in this species the Western Australian shell, suggesting that Thiele's locality was erroneous, but he now finds that Thiele's form is common in New South Wales, and may represent a sexual difference, in any case it cannot be regarded as specific. Other species of *Onithochiton* show somewhat similar variation, and the two extremes always attract attention, so that we have figured both forms.

The Western Australian shells all seem to be of the *scholvieni* type, while some are altogether smooth.

#### ONITHOCHITON ASHBYI.

Plate xxxviii., fig. 3.

*Onithochiton ashbyi* Bednall & Matthews, Proc. Mal. Soc., vii., 1906, 92, pl. ix. f. 2, 2c. South Australia. Type in coll. Bednall, now Matthews.

Shell small, elongate oval, elevated, not carinated, side slopes curved; sculpture of coarse nodules on anterior valve and lateral areas, pleural areas smooth; girdle horny (probably fleshy when alive). Colour rich cream, splashed along the jugal area with bright orange-brown, a few blotches of the same colour at the sides of some valves.

Anterior valve with scattered nodules irregularly and interruptedly rayed; eight rays may be distinguished.

Median valves with lateral areas small but strongly elevated, with two irregular rows of elongated elevated nodules; pleural areas smooth, very finely transversely striate.

Posterior valve with mucro terminal, a little upturned. post-mucronal area present only as an upturned edge with three nodulose ridges present; ante-mucronal area a little concave, smooth.

Girdle horny (in dried type shell).

Interior white. Slits 8-1-0; posterior callus sinuate medially.

Dimensions: 8.5 x 4.5 mm. (curled type).

Station: ?.

Habitat: South Australia.

Remarks: The original figure is poor, as noted by the authors. Our figure and description are from the type. At present only two specimens are known.

Genus LUCILINA.

*Lucilina* Dall, Proc. U.S. Nat. Mus., 1881, 290. New name for *Lucia*. Type by monotypy *Chiton confossus* Gould.

*Lucia* Gould, Proc. Bost. Soc. Nat. Hist., viii., 1862, 283. Type by original designation *Chiton confossus* Gould. Feejees.

*Toniciopsis* Thiele, Das Gebiss der Schnecken (Troschel), ii., 1892, 371. Type by subsequent designation (Thiele, 1909), *Chiton pictus* Reeve.

Shell small to medium, elevated, round-backed or carinated, elongate oval, posterior valve with prominent elevated muero, sculpture of pits and nodules, girdle fleshy, finely spiculose; insertion plates finely pectinated, as is sinus; slits 8-1-12, the posterior insertion plate with a forward tendency. Two well-defined sections are found in Australian waters, the one large, weakly sculptured, round-backed; the other smaller, strongly sculptured, carinated; a third, like the latter but more finely sculptured, occurs throughout the Pacific.

LUCILINA FORTILIRATA.

Plate xxxviii., fig. 11.

*Chiton fortiliratus* Reeve, Conch. Icon., iv., 1847, pl. xviii., sp. & f. 112. Raine's I. Torres Strait. Type in Mus. Cuning in Brit. Mus. Smith, Zool. Coll. Alert, 1884, St. Port Darwin.

*Tonicia fortilirata* Pilsbry, Man. Conch., xiv., 1893, 207, pl. 40, f. 3, 4.

Shell medium, elongate oval, semi-carinated, sculpture very bold, especially on pleural areas; girdle fleshy. Colour yellowish, variegated with green, stained with red in the middle (type). In a series from Darnley Island, Torres Strait, considerable variation is seen, some being wholly red, others greyish splashed with green only, and one with black markings on valves ii., iii., and viii.

Anterior valve with curved separate nodules, apices backward, rayed in a dozen irregular rays, apex smooth.

Median valves with lateral areas raised with two obsoletely nodulose radials bounding the area, about ten nodules to a row, enclosing three or more irregular rows of smaller nodules; pleural areas with about ten broad square-cut ridges with narrow interstices on each side, leaving a very narrow smooth jugal line.

Posterior valve with muero elevated, post-median; post-mueroal slope convex, ante-mueroal area concave, sculpture as pleural areas; post-mueroal area rayed with fine nodules, about twenty rather irregular rows being counted.

Girdle fleshy, becoming horny in dried examples, densely covered with minute spicules.

Interior pinkish-white. Slits 8-1-13.

Dimensions: 28 x 18 mm. (type), 16.5 x 8 mm. (specimen figured and described).

Station: Under stones in coral sand below low water mark; dredged in 8-10 fathoms in sand and mud (Coppinger).

Habitat: Raine's Island, Torres Strait (Ince, type), Port Darwin (Coppinger), Darnley Island (E. H. Matthews).

## LUCILINA RAINFORDIANA.

Plate xxxviii., fig. 10.

*Lucilina rainfordiana* Hull, Proc. Roy. Soc. Queensland, xxxvi., 1924, 115, pl. xxi., f. 3. Port Denison, North Queensland. Type in Queensland Museum.

Shell small to medium, elevated, carinated, side slopes very slightly convex. Colour very variable, brilliant when alive, in most instances fading to dull brown, red or green when dry.

Anterior valve with eleven radiating grooves, the interspaces filled by 4-5 imbricating pustules with the apices directed backward. Ocelli visible all over the valve.

Median valves with lateral areas strongly differentiated, covered with three radiating rows of large flattened imbricating pustules, the central row smaller than the two outer ones; central areas having 10-12 high curved riblets, the bases corresponding with the anterior row of pustules on the lateral areas, and curving inwards to the jugum; ocelli visible on all the valves, mostly scattered along the grooves in the lateral areas.

Posterior valve with mucro very prominent, posterior, nearly straight behind; ante-mucronal area similar to central areas of median valves, with ocelli visible between the riblets; post-mucronal area densely covered with small rounded pustules.

Girdle wide, fleshy, densely covered with minute short chaffy spicules.

Interior bluish-white. Slits 8-1-12-13.

Dimensions: 15 x 7.5 mm. (type), 24 x 15 (maximum measured).

Station: On the under side of stones and dead coral in coral sand below low water mark.

Habitat: Queensland, from Port Denison to the Capricorn Islands.

Remarks: This is the southern form of *L. fortirata*, the principal difference being in its bolder sculpture throughout, but especially marked on the lateral areas.

## LUCILINA SHIRLEYI.

Plate xxxviii., figs. 12, 14.

*Lucilina shirleyi* Iredale, Proc. Mal. Soc., xi., 1914, 131, new name for *Chiton pictus* Reeve. Type in Brit. Mns.

*Chiton pictus* Reeve, Conch. Icon., iv., 1847, pl. xv., sp. & f. 79. Raine's Island, Torres Strait. Type in Mus. Cuming in Brit. Mus. Not *Chiton pictus* Blainville, Dict. Sci. Nat. (Levrault), xxxvi., 1825, 541.

*Tonicia confossa* Gould, Melvill & Standen, Journ. Linn. Soc. (Lond.), xxvii., 1891, 180.

*Tonicia picta* Pilsbry, Man. Conch., xiv., 1893, 211, pl. 40, f. 5, 6.

Shell medium, elongate oval, elevated, round-backed. Colour variable; pinkish-white, showily painted with green and scarlet spots (Reeve); in a very large series, collected by Hull and Rainford along the Queensland coast from Whitsunday Passage to Howick Islands numerous colour varieties occur, some being wholly dark-red, others reddish, splashed with green, others with one or more valves in black. The colouring is very brilliant in living examples, but is not so liable to fade when dry as in the two preceding species.

Anterior valve with rays of inverted V-shaped nodules, subimbricating, showing eyes between.

Median valves with laterals little raised, bounded by two indistinct ribs more or less elongately tile marked, intervening area depressed, faintly nodulose, rows of eyes behind the anterior rib; pleural areas marked with continuation upward of the longitudinal ribs which tend to turn and cross towards the jugum; the jugal area broad, wedge-shaped, smooth but pitted irregularly with jagged dashes.



Posterior valve large, muero elevated at about posterior fourth; post-mucronal slope slightly convex; ante-mucronal area as pleural areas; post-mucronal area faintly nodulose rayed, often almost smooth.

Girdle wide, fleshy, densely covered with minute chaffy spicules.

Interior white. Slits 8-1-12.

Dimensions: 30 x 15 mm., dried example from Darnley Island figured.

Station: On the under side of stones or blocks of dead coral embedded in mud or coral sand, generally above median tide mark, but also found in deeper water.

Habitat: Queensland, from Torres Strait to Capricorn Group.

Remarks: The group to which this species belongs shows so little variation that subspecific rank is probably all the named members are entitled to. As the western (Sharks Bay) series is separable we allow the species until a review with series from each locality is undertaken. The earliest described species is *Chiton lamellosus* Quoy & Gaimard (Voy. Astrol. Zool., iii., 1835, 386, pl. 74, f. 29-32) from Tonga Tabu, then comes *Chiton confossus* Gould (Proc. Bost. Soc. Nat. Hist., ii., 1846, 143) from Fiji.

LUCILINA DILECTA.

Plate xxxviii., fig. 15.

*Lucilina dilecta* Thiele, Die Fauna Sudwest. Aust., iii., Dec., 1911, 397. Shark's Bay, Western Australia. Type in Berlin Museum. Ashby, Trans. Roy. Soc. S. Aust., xlv., 1921, 47, pl. viii., f. 2 a-c.

*Tonicia truncata* Odhner, Kungl. Svenska Vetensk. Handl. Bd., 52, No. 16, 1917, 12.

*Tonicia (Lucilina) dilecta* Ashby, id. ib., xlvii., 1923, 230, pl. xviii., f. 2.

Shell large, like the preceding species, but with stronger sculpture.

Anterior valve more clearly sculptured with smaller wedge-shaped nodules.

Median valves with lateral areas more regularly finely nodulose between the ribs; pleural areas more strongly sculptured with irregular ribs slanting towards the jugum, which is pitted; in some instances fine straight longitudinal ribs develop in the pleural areas, and a very distinct looking shell is seen. That this is only a variant is proved by the fact that some shells show both kinds of sculpture.

Posterior valve with muero more posterior and less elevated; radials on post-mucronal area more pronounced.

Girdle and interior characters as in the preceding species.

Dimensions: 46 x 25 mm.

Station: Mr. Tom Carter collected a number of specimens which had been scraped off pearl oysters at Shark's Bay, Western Australia.

Habitat: Western Australia.

LUCILINA HULLIANA.

Plate xxxviii., fig. 13.

*Tonicia hullianus* Torr, Trans. Roy. Soc. S. Aust., xxxv., Dec., 1911, 104, pl. xxv., f. 4 a-f. Ellenbrook, South Western Australia. Type in coll. Torr.

Shell medium, broad, elliptical, round-backed, side slopes curved. Colour reddish-buff, mottled on dorsal areas, turning to deep red on some of the lateral areas, a few minute irregular black and white spots.

Anterior valve with about 15 or more fine striae radiating from the apex, with a slightly raised rib between each pair, each rib bearing ocelli.

Median valves: the second is larger than the succeeding five; lateral areas with three to five almost obsolete flattened ribs, with ocelli in the interstices.

pleural areas almost smooth, crossed by growth lines, and having a few rudimentary pits; jugum smooth, flecked anteriorly with triangular white markings.

Posterior valve with mucro prominent, terminal; post-mucronal slope perpendicular; ante-mucronal area as pleural areas; post-mucronal area finely irregularly rayed, the rays crossed by growth lines.

Girdle fleshy, covered with minute chaffy spicules.

Interior pearly white. Slits 8-1-12.

Dimensions: 30 x 20 mm.

Station: Under a stone in a rock pool.

Habitat: Ellenbrook, south of Cape Naturaliste, Western Australia.

Remarks: Dr. Torr kindly lent us his type shell for examination and figuring. The species appears to be a remarkably smooth form of *L. dilecta* Thiele. As both species were described simultaneously, the descriptions appearing in December, 1911, priority must be given to Torr's name should examination of a series show that both forms are found in the southern locality, as Torr's shell was figured, while Thiele's was not.

#### LUCILINA CARPENTERI.

*Tonicia carpenteri* Angas, P.Z.S., 1867, 116, pl. 13, f. 30. Port Jackson, Australia. Type in Brit. Mus. Pilsbry, Man. Conch., xiv., 1893, 208, pl. 40, f. 7.

"Shell ovate, elevately convex, carinated, ashy white, ornamented at the binder edges of the valves with pale spots, the spaces between which are very dark olive, melting into confused bands of a paler hue which extend nearly across the valves; valves rostrate, undulately concentrically subimbricately sculptured throughout; the lateral areas not raised but separated from the dorsal areas by an elevated rib. Posterior valve strongly gibbous, the umbo almost terminal; mantle margin brown. Length 9 lines. (Angas).

Pilsbry publishes Carpenter's descriptive notes, as follows:—"One specimen without anterior valve. The specimen as it stands measures length 17, breadth 15 mill.; but measuring the valves only and allowing for the missing anterior valve it would be length 16, breadth 10 mill. Shell oval, moderately elevated, the dorsal ridge acute; olive clouded with dark, tessellated with light so as to appear toothed at the sutures. Mucro central, swelling, elevated, the posterior slope convex. Jugal area a rather narrow, nearly smooth dorsal line. Central areas with about 16 finely, rugosely sculptured, nearly concentric, but faint, grooves on the otherwise smooth surface. Lateral areas slightly raised by the curved diagonal; having lines of stumpy granules and concentrically rugosely grooved in continuation of the sculpture of the central areas, obsolete at sutures. Posterior valve concentrically grooved like the rest, all around. Girdle nearly smooth, very slightly lanugate. Posterior valve with 11 slits; teeth rather sharp, grooved outside. eaves very small. Sinus broad, flat, deep, having about 17 very slight teeth.

This species is a transition toward *Acanthopleura* in the thrown-forward teeth, but girdle and sinus are more Tonicoid."

We record this species with reservations. Many years of intensive collecting in Port Jackson have failed to disclose another example, and the genus is not known to occur on the eastern coast of Australia south of the Capricorn group. From its description and figure it suggests a weakly sculptured *L. forvirata*. Iredale, from examination of the type, was unable to locate it, and is of opinion that it did not come from Port Jackson.

## Genus SCHIZOCHITON.

*Schizochiton* Gray, P.Z.S., 1847, 65, 68. Type by monotypy *Chiton incisus* Sowerby.

Shell large, elongate, narrow, elevated, carinated, posterior valve deeply fissured, girdle spiculose, posteriorly slit; anterior insertion plate six-slit, corresponding with the external rows of ocelli, which, however, sometimes number 7 or 8, the additional rows developing at the edges; teeth denticulate; median valves with one or two slits on each side; sinus obsolete, finely denticulate. The genus is recognisable at sight by the fissured posterior valve, and the great development of the ocelli is a very remarkable feature.

SCHIZOCHITON POLYOPS, n.sp.

Plate xxxviii., figs. 16, 17, 19-21.

*Chiton elongatus* Reeve, Conch. Icon., iv., 1847, pl. viii., sp. & f. 40, a, b. Raines Island, Torres Strait. Capt. Ince. Type in Mus. Cuming in Brit. Mus. Not *Chiton elongatus* Blainville, Diet. Sci. Nat. (Levrault), xxxvi., 1825, 542.

*Schizochiton elongatus* Brazier, Proc. Linn. Soc. N.S.W., ii., 1877, 75. North Queensland.

*Schizochiton incisus* E. A. Smith, Zool. Coll. Alert, 1884, 82. North Queensland. Not *Chiton incisus* Sowerby, P.Z.S., 1841, 61. I. Zebu, Philippine Islands. Haddon, Zool. Rep. Challenger, xvi., 1886, Polypl., 31. Melville & Standen, Journ. Linn. Soc. (Lond.), Zool., xxvii., 1891, 181.

Shell large, elongate, narrow, elevated, carinated. Colour greyish-white, flamed with brown, principally on the jugum, but sometimes so densely covered with colour markings that the whitish ground colour is almost entirely obscured.

Anterior valve with six notable rays of ocelli, between which are wavy or zig-zag grooves, with ridges between being narrow, square-cut, of about the same width.

Median valves with lateral areas small, very slightly raised, but a prominent ray of ocelli on the diagonal, the area being sculptured concentrically with grooves and ridges similar to those on the anterior valve; these pass over and cross the pleural areas in all the valves except the second, on which they only cross at the edges and less than half way, otherwise leaving a large wedge-shaped jugal area, smooth, with longitudinal pitting; in the other valves the jugal area is a very narrow smooth band.

Posterior valve as long as valve vii., with mucro elevated, terminal, deeply fissured on the post-mucronal area, which bears three rays on each side of the fissure similar to those on the anterior valve and similarly sculptured between; ante-mucronal area as pleural areas.

Girdle very broad, fleshy, densely finely spiculose, with bunches of larger spicules at the sutures.

Interior white, sometimes pinkish or greenish, with a large purple blotch medially. Slits 6-7—1-2—5-6. Sinus erenulated.

Dimensions: 50 x 22 mm.

Station: In crevices or on the under side of loose blocks of dead coral; sometimes under stones embedded in mud or coral sand at or above low water mark.

Habitat: North Queensland, from Cooktown to Torres Strait.

Remarks: This species differs from *S. incisus* Sowerby from the Philippine Islands in the more numerous grooves and ridges on the lateral and central areas, and in the greater number of ocelli, the latter feature suggesting the name proposed. The jugum is also smooth or nearly so, while that of the northern species is striated.

## APPENDIX A.

## TERATOLOGY.

Malformations, or deviations from the normal type of structure, in the form of shells possessing less than eight valves, are referred to in the first section of this Monograph under the heading "Teratology." Linnaeus (Syst. Nat., ed. x., 1758, 667) listed four species of the genus *Chiton*; *C. hispidus*, which he described as 6-valved, *C. tuberculatus*, 7-valved, and two other species 8-valved, indicating that he regarded the normal number of valves as varying from six to eight. Schumacher, the author of the ordinal name LORICATA, defined the group as consisting of shells with six or eight valves. Fleming (Hist. Brit. Anim., 1828, 289) describing *Chiton marginatus* Pennant (= *Ischnochiton cinereus* Linn.) stated "I possess a variety of this shell, which I found under a stone at Newhaven in 1811, with only six valves." He also refers to the *C. crinitus* of Pennant, which the latter described as "with seven valves."

Pilsbry, in the introduction to his Manual, said: "It is likely that the six-valved were artificial fabrications, although a certain number may perhaps be traced to incorrect drawings. Most seven-valved specimens are due to the soldering together of two valves in consequence of some injury. This is not uncommon, a number of cases having come under my observation. Individuals actually seven-valved are known to occur, although they are far from common. The writer has examined many thousand Chitons, but has only seen two normally 7-valved examples. One of these is figured . . . and as may be seen, it is in no respect abnormal save in the want of one central valve, and the consequent lengthening of the others. There is absolutely no trace of the missing valve. The absence of a valve produces no striking change in the general appearance of the animal, and it would be easy to pass one by among a quantity. These considerations incline me to think that abnormalities in the valves may be less rare than supposed."

Henn (P.L.S., N.S.W., ser. 2, ix., 1894, 178) in describing the contents of a bottle found in a rock pool at low water, Watson's Bay, Sydney, recorded "*Cryptoplax striatus* Lam. One specimen, three valves." Nierstrasz and Pelseneer both misread this as meaning a specimen having three valves only, whereas it was a normal specimen and three separate valves. Oliver has quoted Pelseneer, without questioning the accuracy of the record.

Bednall (Proc. Mal. Soc., ii., 1897, 154) under the heading of *Plaxiphora conspersa* Ad. & Ang. (= *Kopionella matthewsi* Iredale) quotes Pilsbry in part, and adds "Mr. Matthews is in possession of a veritable six-valved specimen of *P. conspersa*." This shell is still in the Matthews collection, and another similar 6-valved specimen, collected by Matthews, was included in a series of six examples of that species presented to the British Museum by Bednall, but it remained unnoticed until Iredale detected it in 1910.

Iredale (Trans. N.Z. Inst., xi., 1907, 375) recorded the occurrence of a 5-valved specimen of *Chiton pelliserpentis* Q. & G., and a 6-valved *Plaxiphora ovata* Hutton, from New Zealand. The same author (Proc. Mal. Soc., ix., 1910, 156) recorded *Sclerochiton curtisianus* Smith (= *Squamopleura curtisiana*) with seven valves, collected by him at Port Curtis, Queensland; two 7-valved *Ischnochitons* from the Kermadec Islands (= *I. kermadecensis* Iredale), and a 7-valved *Craspedochiton cinereus* Linn., collected by him at Seaseale, Cumberland, England.

May and Torr ("The Polyplacophora of Tasmania," Pap. & Proc. Roy. Soc. Tas., 1912, 29) under *Ischnochiton crispus* Reeve (= *I. elongatus elongatus* Blainville), place on record that "A very unusual five-valved specimen was found by W. G. Torr at Ulverstone (Tasmania) in July, 1908,"

Oliver ("Variation in Amphineura," Trans. N.Z. Inst., liii., 1921, 361) quotes previous records of abnormal extra-limital Loricates, and (in addition to those already mentioned in this Appendix) *Onithochiton neglectus*, with seven valves, from New Zealand, and describes a specimen of *Callochiton (Levicoplax) platessa* Gould, having seven valves on the left side only.

S. Stillman Berry (Ann. & Mag. Nat. Hist., ser. 9, xvi., July, 1925, 174) described an abnormal specimen of *Acanthopleura granulata* Gmelin from Key Vacca, Florida, which he considered sufficiently unusual to be made of record. "The malformation consists not only in the reduction of the number of valves from eight to seven—an abnormality amply rare enough in itself to have induced comment practically wherever noted,—but in the evident manner in which this has come to pass and the striking deformity which has resulted." In this specimen the abnormality was caused by the fusion of valves i. and ii., resulting in a greatly elevated and beaked valve of twice the normal length. Berry refers, in the same paper, to Crozier's record (Amer. Nat., 53, 1919, 278) of two specimens of *Chiton tuberculatus* Linn., collected at Bermuda, in which the last two plates were similarly coalesced.

The example having three valves only, referred to in our introductory section, as being in the British Museum, belongs to the species *Ischnochiton contractus* Reeve (= *I. lineolatus* Blainville), and was collected in Victoria by Mrs. Kenyon, and recorded by Sykes (Journ. Malac., vii., 1900, 164, text-fig. 1).

The foregoing records of abnormal examples are quoted chiefly to show how rare such aberrants were considered by the authors cited. The comparatively large number of examples recorded by us is due, not only to a very keen examination of all specimens passing through our hands, but to the extremely rich field provided by the Australian littoral. It is no exaggeration to say that a collector could easily take 1,000 Loricates, comprising at least twenty species, during one period of low water in Sydney Harbour, or any other fairly sheltered spot in the sandstone region.

In May, 1925, Hull (P.L.S., N.S.W., 1, 1925, xxxix.) exhibited at a meeting of the Linnean Society of New South Wales 40 examples of abnormal Loricates, having less than eight valves. Twenty species were represented, and there were specimens having five, six, or seven valves. In September, 1925, he exhibited specimens of two species of Loricates having nine valves each (*loc. cit.*, xliii.).

In examining some 30-40,000 Australian Loricates we have seen 78 specimens of 31 species having seven valves, and showing in only a few instances a trace of injury or fusion of two valves. There is no "consequent lengthening of the others," such as Pilsbry describes in the case of his specimen. They are nearly all obviously congenital abnormalities, and the loss of one valve has not had any apparently injurious effect on the animals. In fact, many are particularly fine, healthy examples. We have also found 17 examples of nine species having six valves, but have not so far found one with five; Torr's *I. crispus* is the only 5-valved example of an Australian species known to us. In addition to the apparently congenital examples we have found numerous specimens in which injury has resulted in (a) the fusion of two valves, which form one of abnormal proportions (Plate xxxix., figs. 2 and 16), (b) the loss of one side of a median valve, and the complete closure of the resulting gap, with a consequent shortening of the injured side and curvature of the dorsum (Plate xxxix., fig. 18), and (c) the fracture of one or more valves dorsally, with a curious recurved prolongation of the fractured edges resulting from a determined effort on the part of the animal to effect repair of the damage. The lastnamed abnormality is illustrated by figures 17 and 18 of plate xxxix., and doubtless is the result of



the complete fracture of the organic frame upon which the calcareous deposit forming the shell is lodged.\*

The discovery by Hull in 1925 of two perfect examples having nine valves was a striking proof of Pilsbry's suggestion as regards seven-valved examples that "it would be easy to pass one by among a quantity." The specimens had been in his possession, one for four, and the other for two years, and it was only when he was carefully examining his whole collection for abnormalities that these remarkable departures from the normal were noticed. They are both figured on plate xxxix. (figs. 14 and 15), and present no trace whatever of fission or any injury which might result in the formation of an additional valve. Each of the seven median valves is perfectly and symmetrically graduated, as in the case of a normal specimen having six median valves. In each case valve ii. is longer, narrower, and more elevated than the remainder; valves iv., v., and vi. are practically of the same dimensions, while valve vii., and the adventitious one show a gradual reduction in width to meet the narrow tail valve. Recently Mr. E. M. Matthews returned from Darnley Island, Torres Strait, the proud possessor of a third nine-valved example, with the extraordinary report that some local residents had informed him that such extravagant shells were "quite common."

In appending a list of species of the abnormal Australian Loricates recorded, and that we have seen, or know are possessed by several Australian collectors, we would hazard the estimate that about 2 per 1,000 of the specimens examined by us exhibit congenital departures from the normal eight valves. The figure placed after the name of the collector indicates the number of examples of each particular variety possessed by such collector.

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\* By immersing a Loricata in a 25 per cent. solution of muriatic acid the calcareous deposit will be discharged and the gelatinous frame, with all its details of sculpture, will remain.

#### LIST OF ABNORMAL AUSTRALIAN LORICATES.

(Those marked \* have been previously recorded.)

- Ischnochiton elongatus elongatus*, 5-valved, Torr 1\*; 7-valved, Hull 5.  
*Ischnochiton elongatus crispus*, 6-valved, Hull 3, McAndrew 1; 7-valved, Hull 7, McAndrew 2.  
*Ischnochiton examinandus examinandus*, 7-valved, Hull 1  
*Ischnochiton lineolatus*, 3-valved, Brit. Mus. 1 (*I. contractus*\*).  
*Ischnochiton versicolor versicolor*, 7-valved, Hull 7, McAndrew 2.  
*Ischnochiton examinandus examinandus*, 7-valved, Hull 1.  
*Heterozona cariosa*, 7-valved, Hull 1.  
*Heterozona subviridis*, 7-valved, Hull 1.  
*Ischnoradsia australis australis*, 6-valved, Hull 1; 7-valved, Hull 1, McAndrew 3.  
*Ischnoradsia evanida novae-hollandiae*, 7-valved, Hull 1.  
*Haploplax smaragdina*, 6-valved, Hull 1, McAndrew 4; 7-valved, Hull 1, McAndrew 3.  
*Haploplax lentiginosa*, 6-valved, Hull 1.  
*Haploplax arbutum*, 7-valved, Hull 1.  
*Icoplax mayi*, 7-valved, Aust. Mus. 1.  
*Levicoplax platessa*, 6-valved, Brit. Mus. 1; 7-valved, Hull 3, Ashby 1.  
*Eudoxoplax inornata*, 7-valved, Hull 1, Torr 2.  
*Lorica volvox*, 7-valved, Hull 1; 7½-valved, Hull 1.  
*Loricella angasi*, 7-valved, McAndrew 1, Hull 1.  
*Kopionella matthewsi*, 6-valved, Matthews 1\*, Brit. Mus. 1\*.

- Acanthochiton granostriatus*, 7-valved, Hull 1.  
*Meturoplax retrojecta*, 7-valved, Hull 1.  
*Notoplax gabrieli*, 6-valved, Hull 1.  
*Craspedoplax variabilis*, 7-valved, Hull 2.  
*Craspedoplax elegans*, 7-valved, Hull 1.  
*Cryptoplax iredalei*, 7-valved, Hull 1.  
*Poneroplax paeteliana*, 7-valved, Hull 1.  
*Delicatoplax translucens*, 7-valved, Hull 1.  
*Rhyssoplax cori*, 7-valved, Hull 2.  
*Rhyssoplax jugosa*, 7-valved, Hull 7, MeAndrew 5; 7½-valved, Hull 2.  
*Rhyssoplax tricostalis*, 7-valved, Hull 1, Matthews 1.  
*Mucrosquama carnososa*, 7-valved, Hull 1.  
*Sypharochiton septentriones*, 6-valved, Hull 1; 7-valved, MeAndrew 1.  
*Squamopleura curtisiana*, 7-valved, Hull 1.  
*Liolophura gaimardi*, 7-valved, Hull 1.  
*Clavarizona hirtosa*, 7½-valved, Hull 1.  
*Acanthozostera gemmata*, 6-valved, Aust. Mus. 1; 9-valved, Hull 1\*, Matthews 1.  
*Onithochiton quercinus*, 7-valved, Hull 1, MeAndrew 1; 9-valved, Hull 1\*.
- Recapitulation*.—3-valved, 1 example; 5-valved, 1 example; 6-valved, 17 examples of 9 species; 7-valved, 78 examples of 31 species; 7½-valved, 4 examples of 3 species; 9-valved, 3 examples of 2 species. Total aherrants, 102 examples of 37 species.

EXPLANATION OF PLATES.

Plate xxxvii.

- Fig. 1. *Amaurochiton glaucus* Gray, whole shell.  
 2. *Sypharochiton septentriones* Ashby, whole shell.  
 3. *Sypharochiton mauganus* Iredale & May, half median valve, smooth var.  
 4. *Sypharochiton septentriones* Ashby, posterior valve, side view.  
 5. *Squamopleura curtisiana* Smith, whole shell.  
 6. *Sypharochiton mayi* Pilsbry, posterior valve, inside view.  
 7. *Sypharochiton mayi* Pilsbry, posterior valve, side view.  
 8. *Sypharochiton mayi* Pilsbry, whole shell.  
 9. *Clavarizona hirtosa* Blainville, anterior valve.  
 10. *Clavarizona hirtosa* Blainville, half median valve.  
 11. *Clavarizona hirtosa* Blainville, posterior valve.  
 12. *Clavarizona hirtosa* Blainville, girdle scales.  
 13. *Liolophura gaimardi* Blainville, anterior valve.  
 14. *Liolophura gaimardi* Blainville, half median valve.  
 15. *Liolophura gaimardi* Blainville, posterior valve.  
 16. *Liolophura gaimardi* Blainville, girdle covering.  
 17. *Clavarizona hirtosa* Blainville, posterior valve, inside view.  
 18. *Squamopleura carteri* Iredale & Hull, girdle scales.  
 19. *Liolophura gaimardi* Blainville, posterior valve, inside view.  
 20. *Squamopleura carteri* Iredale & Hull, whole shell.  
 21. *Clavarizona hirtosa* Blainville, whole shell.  
 22. *Amaurochiton glaucus* Gray, girdle scales.  
 23. *Liolophura queenslandica* Pilsbry, anterior valve.  
 24. *Liolophura queenslandica* Pilsbry, half median valve.  
 25. *Liolophura queenslandica* Pilsbry, posterior valve.  
 26. *Squamopleura curtisiana* Smith, posterior valve, inside view.  
 27. *Squamopleura curtisiana* Smith, girdle scales.  
 28. *Squamopleura carteri* Iredale & Hull, posterior valve, inside view.  
 29. *Sypharochiton septentriones* Ashby, girdle scales.

30. *Liolophura queenslandica* Pilsbry, girdle covering.
31. *Liolophura gaimardi* Blainville, whole shell.
32. *Liolophura queenslandica* Pilsbry, whole shell.
33. *Acanthozostera gemmata* Blainville, posterior valve, inside view.
34. *Acanthozostera gemmata* Blainville, whole shell.

## Plate xxxviii.

- Fig. 1. *Acanthopleura spinosa* Bruguiere, whole shell.
2. *Acanthopleura spinosa* Bruguiere, posterior valve, side view.
  3. *Onithochiton ashbyi* Bednall & Matthews, whole shell.
  4. *Onithochiton quercinus* Gould, whole shell.
  5. *Onithochiton quercinus* Gould, whole shell, smooth form from Western Australia.
  6. *Onithochiton quercinus* Gould, anterior valve.
  7. *Onithochiton quercinus* Gould, half median valve.
  8. *Onithochiton quercinus* Gould, posterior valve.
  9. *Onithochiton quercinus* Gould, girdle covering.
  10. *Lucilina rainfordiana* Hull, whole shell.
  11. *Lucilina fortilirata* Reeve, whole shell.
  12. *Lucilina shirleyi* Iredale, posterior valve, side view.
  13. *Lucilina hulliana* Torr, whole shell.
  14. *Lucilina shirleyi* Iredale, whole shell.
  15. *Lucilina dilecta* Thiele, whole shell.
  16. *Schizochiton polyops* Iredale & Hull, whole shell.
  17. *Schizochiton polyops* Iredale & Hull, half median valve.
  18. *Schizochiton incisus* Sowerby, half median valve.
  19. *Schizochiton polyops* Iredale & Hull, posterior valve from behind.
  20. *Schizochiton polyops* Iredale & Hull, posterior valve from above.
  21. *Schizochiton polyops* Iredale & Hull, posterior valve from side.

## Plate xxxix.

- Fig. 1. *Sypharochiton pelliserpentis* Quoy & Gaimard, having five valves, resulting from fusion of ii. and iii., and vi. and vii.; valve iv. or v. wholly absent. (New Zealand).
2. *Ischnochiton elongatus crispus* Reeve, having six valves; valves iv. and v. fused, valve vii. wholly absent.
  3. *Ischnochiton versicolor versicolor* Sowerby, 7-valved.
  4. *Ischnoradsia evanida novae-hollandiae* Reeve, 7-valved.
  5. *Haploplax smaragdina* Angas, 7-valved.
  6. *Levicoplax platessa* Gould, 7-valved.
  7. *Lorica volvox* Reeve, 7-valved.
  8. *Rhyssoplax cori* Pilsbry, 7-valved.
  9. *Rhyssoplax jugosa* Gould, 7-valved.
  10. *Rhyssoplax tricostalis* Pilsbry, 7-valved.
  11. *Liolophura gaimardi* Blainville, 7-valved.
  12. *Squamopleura curtisiana* Smith, 7-valved.
  13. *Poneroplax paeteliana* Thiele, 7-valved.
  14. *Onithochiton quercinus* Gould, 9-valved.
  15. *Acanthozostera gemmata* Blainville, 9-valved.
  16. *Eudocoplax inornata* Tenison-Woods, having valves vi. and vii. fused.
  17. *Liolophura queenslandica* Pilsbry, showing fracture and attempted repair of valve iii.
  18. *Rhyssoplax jugosa* Gould, showing fracture of valve iv., attempted repair of the left-hand half, and complete loss of right-hand half; with closure of consequent gap, and resultant curvature of dorsum.